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ABSTRACT

This study assesses, via the description of a performance typology, that portion of a sample of educable retarded boys whose profiles over four factor-defined components of the motor domain resemble those profiles subtended by intellectually normal boys over the same four components. Tryon's Condensation Method was used to develop person-clusters for 71 educable mentally retarded boys and 71 boys of normal intelligence for four main performance components: (a) strength/power/body size, (b) gross body coordination, (c) fine motor abilities, and (d) balance. This multivariate approach allows the comparison of performance capabilities simultaneously over the many recognized components of the motor domain and the assessment of that portion of a retarded sample whose subtended performance profiles resemble those of the intellectually normal. Results indicate that while there exist marked differences between the performance profiles of educable retarded and intellectually normal boys, the motor abilities of about one-quarter of the educable retarded boys were no different from those of the majority of intellectually normal boys. (PD)

Person - Clusters of Intellectually Normal and Educable Mentally Retarded Boys on Selected Motor Performance Variables*

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As is the case for the intellectual domain it has now been well established that the motor domain is not composed of a single unitary ability, but rather a complex of several abilities and many specific traits. Descriptions of the factor structure of the motor domain of high school and college aged males and females have identified such general factors as static strength, dynamic strength, explosive strength, gross body coordination, balance (static and dynamic), endurance (muscular and cardio-respiratory) and flexibility. (Fleishman, 1964; Cumbee, 1954; Jackson, 1971; Larson, 1941; McCloy, 1956; and Rarick, 1937).

Any attempt to therefore assess the motor performance of individuals by means of a single test in reality describes performance capabilities on only one aspect of the motor domain. The multivariate approach, that is the assessment of performance capabilities simultaneously over many variables, is a more meaningful approach. Basic to a multivariate approach is the development for each subject of a vector of scores composed of that subject's score on each variable. Development of a pattern or profile of scores for each subject provides an assessment not available when performance is described on a single variable only, namely the establishement of clearly defined person types or person-clusters. This is accomplished by the separation of dissimilar profiles and the grouping of similar profiles.

The development of person-clusters mandates the solving of two problems. The first, the problem of domain representation, involves the selection of variables upon which subjects are to be clustered. The second,

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the process of pattern matching, involves the selection of a set of score patterns that are to some degree representations of the full array of profiles of all subjects. The selection of meaningful materials is easily handled by data reduction techniques such as factor or cluster analysis. Methods of inverse factor analysis such as Stephenson's Q Methodology can also be used for pattern matching. A more recent approach is that of Tryon's Object or O-analysis (Tryon, 1967).

The recognition of person types has generally been linked to an attempted prediciton of behavior on other traits. Stephenson's (1939) application of the Q-sort technique to Jungian typology and Sheldon's (1963)somatotyping linked to the prediction of psychological traits may well be two of the better known examples. However, person-clustering on the basis of like performance profiles can also be used to recognize those individuals who differ in ability on one trait but who nevertheless have similar performance spectra on other ability traits.

As of this time it has been well established that the performance levels of the educable mentally retarded (EMR) are infereior to those of normal intellect. (Malpass, 1959; Marick, et al., 1970; Treadgold, et al., 1956; Widdop, 1967; Rabin, 1957; Marick and Dobbins, 1972) Francis and Marick (1960) suggest that there exists a two to four year lag in performance levelsof the educable retarded. However, even though the differences between the group means of the educable retarded and the intellectually normal samples are invariably shown to be statistically significant in excess of the standard levels of significance, typically these differences are less than the corresponding standard deviations of the retarded samples. This strongly suggests that some of the educable retarded achieve at a level better than the average performance of the intellectually normal group. In this respect the performance of these retardates is more alike that of

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the intellectually normal than it is alike their educable peers.

The purpose of this study is to assess, via the description of a performance typology, that portion of a sample of educable retarded boys whose profiles over four factor-defined components of the motor domain resemble those profiles subtended by intellectually normal boys over the same four components.

Subjects

Seventy-one boys classified as educable mentally retarded and seventy-one boys of normal intelligence served as subjects. Both groups were from schools in the San Francisco Bay area. The mean chronological age of the retarded boys was 102.7±13.6 months, that of the normal boys was 100.7±13.5 months. The mean I.Q. of the retarded boys in standard score form was - 2.17±.69. The IQ.'s of approximately 80 percent of these subjects were obtained from the WISC, the remaining 20 percent from the Stanford-Binet. The I.Q. tests were all administered by school district psychologists.

Procedures

An earlier reported study by Rarick and Dobbins (1972) identified the same four main performance components of the motor domain for these subjects. These components labeled Strength/Power/Body Size, Gross Body Coordination, Fine Motor Abilities and Balance, form the four dimensions upon which the person-clustering is based. The variables that best describe these components are given in Table 1. Test write-ups and administration instructions have been reported earlier. (Rarick and Dobbins, 1972) Correlation coefficients computed for both the educable retarded and intellectually normal samples showed the existence of a substantial relationship between chronological age and many of the variables utilized in this study

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causing these performance distributions to be skewed towards the older ages. To eliminate the possible confounding effect of age in the development of person-clusters, each subject's raw score on each variable was adjusted to a common age of 100 months by the method of least squares in conjunction with the correlation between that variable and chronological age. It is these adjusted scores that were submitted to the clustering procedure.

The method used to develop the person-clusters follows that derived by Tryon (1967) called the Condensation Method. A first step in this method is to compute scores for each subject on each of the four components of the motor domain. Each subject's score on the first component would be the summed standard scores over those variables that describe that component. These summed scores are then transformed into standard scores, the distribution of which has a mean of 50 and a standard deviation of 10. Each subject's composite standard score for the three remaining components would be similarly computed to generate a total of four composite standard scores, one for each dimension of the motor domain. These scores form an orthogonal Cartesian Space of four dimensions. Each subject is plotted as a point in this four dimensional space, his locus being determined as his four scores taken as coordinates. It is the line graph through these four coordinates on four vertical axes that gives a subject's profile. The similarity or difference between any two profiles is objectively determined in the Cartesian Space as the distance between any two points. Evaluation of this distance, called the Euclidean Distance, allows the Condensation Method to cluster like individuals in terms of their Cartesian Space similarities.

Results

Ten different types or person-clusters accounted for 130 or 97

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percent of all subjects. The performance profiles of three subjects, all educable retarded, were unique enough not to be allowed membership in any of the ten person-clusters formed. Table 2 gives the means and standard deviations for each of the four components of the ten different person-clusters. Figure 1 displays these means and also gives the constituent memberships by intellectually normal and educable retarded boys for each of the person-clusters. Clearly there is a substantial separation between the educable retarded boys and the intellectually normal boys.

The three person-clusters, clusters 1 - 3, that contain the majority of the intellectually normal boys generally reflect mean composite performance scores that are superior to those displayed by the five person-clusters, clusters 6 - 10, that reflect the performance spectra of the educable retarded. Person-clusters 1 and 3 describe a person type whose performance is above average on all four major components of the motor domain. This general superiority is more pronounced for person-cluster 3 than it is for person-cluster 1. Cluster 2 contains individuals whose Strength/Power/Body Size, Coordination and Fine Motor Abilities are substantially above average but whose Balancing performance is relatively poor and below average. Person-clusters 4 and 5 contain no great imbalance of educable retarded or intellectually normal boys. Person-cluster 4, with the exception of the two boys of Cluster 8 and the two boys of Cluster 11, is the only cluster where intellectually normal boys demonstrate Strength/Power performance that is below average. Cluster 5 is somewhat unique as it is the only cluster to be described by performance above average on two components (Strength/Power and Fine Motor) and below average on two components (Coordination and Balance). Of those person-clusters that contain the majority of the educable retarded, one cluster, Cluster 6, is characterized

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by performance levels more than one standard deviation below the mean on each of the four components of the motor domain. The four remaining clusters that contain the majority of the educable retarded are similar in that they describe performance profiles that are above average on one component and below average on the three remaining components. For Cluster 7 the above average component is Balancing performance, for Cluster 8 it is Coordination, for Clusters 9 and 10 the above average components are Strength/Power and Fine Motor Abilities respectively.

Table 3 gives the percentage contributions of each person-cluster to the educable retarded and the intellectually normal groups also to the total sample. The discrimination between the intellectually normal and the educable retarded is obvious from this table. For example, Clusters 1, 2, 3 and 4 account for 86 percent of the intellectually normal sample but only 23 percent of the educable retarded sample. Person-clusters 6 - 10 account for 73 percent of the educable sample but only 7 percent of the intellectually normal sample. The membership of clusters 6 and 7 is exclusively educable retarded and accounts for about one third of the educable sample. Cluster 6, which alone accounts for about one quarter of the sample, is that cluster with described performance capabilities over one standard deviation below the mean on each of the four components.

Discussion

The univariate approach to the comparison of performance levels of educable retarded and intellectually normal groups tends only to catalogue differences between the samples. The multivariate approach, besides allowing a comparison of performance capabilities simultaneously over the many recognized components of the motor domain, can by the clustering of like performance profiles assess that portion of a retarded sample whose

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subtended performance profiles resemble those of the intellectually normal.

Of the ten person-clusters developed in this study, four of the clusters accounted for the majority (86 percent) of the intellectually normal boys. Five different person-clusters accounted for the majority (73 percent) of the educable retarded boys. Clearly a marked discrimination is evident between the placements of the educable retarded and the intellectually normal into the developed person-clusters. The profiles of those person-clusters that contain the majority of the intellectually normal boys generally reflect superior performance levels for this group, a finding wholly in accord with the results of previous research utilizing univariate techniques. (Malpass, 1959; Treadgold, 1956; Widdop, 1967; Francis and Rarick, 1960; Rabin, 1957).

However, the four person-clusters that accounted for 86 percent of the intellectually normal boys also accounted for 23 percent of the educable retarded boys. Or, the performance profiles of about 1 in 4 of this sample of educable retarded boys do not differ from those profiles that describe the performance capabilities of the majority of the intellectually normal boys of this study. The mean I.Q. of these retardates is higher than that of the other 77 percent of the retarded sample at - 1.74$\pm$.79 to - 2.29$\pm$.72 standard deviation units respectively, but the difference in raw score terms amounts to less than eight I.Q. points.

Thus, while there exist marked differences between the performance profiles of educable retarded and intellectually normal boys, the motor abilities of about one quarter of the educable retarded boys were no different from those of the majority of intellectually normal boys.

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Table 1 The Factor-Defined Components of the Motor Domain and the Variables That Best Describe These Factors

Factor 1. Strength/Power/Body Size

- Height
- Weight
- Grip Dynamometer Strength (Right)
- Grip Dynamometer Strength (Left)
- Bicycle Ergometer No. Rev. in 90 Sec. (Res. = 1.5 kp)

Factor 2. Gross Body Coordination

- Vertical Jump
- 35 Yard Dash
- Standing Broad Jump
- Scramble
- 150 Yard Run

Factor 3. Fine Motor Abilities

- Adapted Minnesota Manipulative
- Purdue Pegboard
- 2-Plate Tapping Test
- Ring Stacking Test
- Golf Ball Transfer Test

Factor 4. Balance

- Railwalk Forward
- Railwalk Backward
- Railwalk Sideways
- Stork Stand

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Table 2 Means and Standard Deviations of each Dimension of the Motor Domain for the Ten Person-Clusters.

Means.

Cluster No.	Strength/Power Body Size.	Gross Coordination.	Fine Motor Abilities.	Balance.
1	55.90	51.83	52.75	56.07
2	63.04	58.31	54.68	47.74
3	58.70	60.92	60.04	59.43
4	42.67	51.91	57.06	58.43
5	55.26	45.89	50.86	43.76
6	37.97	37.76	34.28	36.96
7	45.01	46.75	43.69	56.82
8	41.66	50.00	43.53	44.32
9	53.09	45.55	40.17	36.36
10	39.81	42.34	53.08	44.75

Standard Deviations.

Cluster No.	Strength/Power Body Size.	Gross Coordination.	Fine Motor Abilities.	Balance.
1	4.11	4.07	3.09	3.62
2	4.98	4.93	4.25	3.84
3	4.63	3.24	4.27	4.34
4	4.72	4.23	4.20	4.96
5	6.63	3.22	3.36	2.95
6	5.98	5.74	3.84	6.36
7	3.49	3.51	2.41	4.60
8	4.13	2.84	4.89	3.89
9	4.99	6.53	3.30	5.24
10	5.47	6.98	2.16	4.78

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Table 3 Percentage Distributions of Educable Mentally Retarded and Intellectually Normal Boys by Person-Clusters and Components of the Motor Domain

Percentage allocation by sample to each person-cluster and the percentage of each person-cluster to the total sample

Cluster No.	Educable Retardate	Int. Normal	Total Sample
1	7%	20%	14%
2	1%	14%	8%
3	3%	35%	18%
4	12%	17%	14%
5	4%	7%	6%
6	24%	0%	12%
7	9%	0%	4%
8	18%	3%	10%
9	13%	1%	7%
10	9%	3%	6%

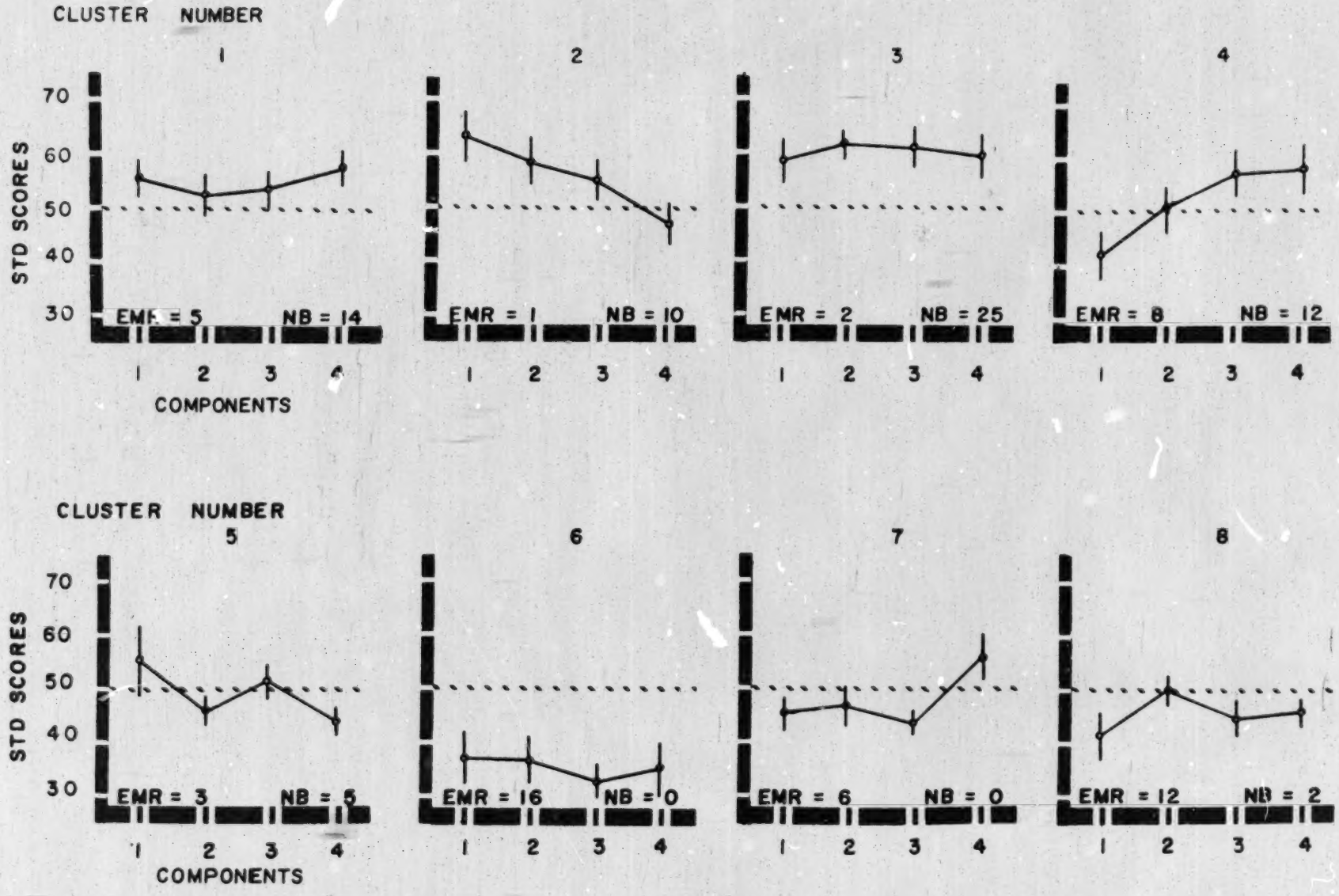

FIGURE 1. MEAN COMPOSITE STANDARD SCORES FOR THE FOUR MAJOR PERFORMANCE COMPONENTS OF THE MOTOR DOMAIN FOR TEN PERSON-CLUSTERS.

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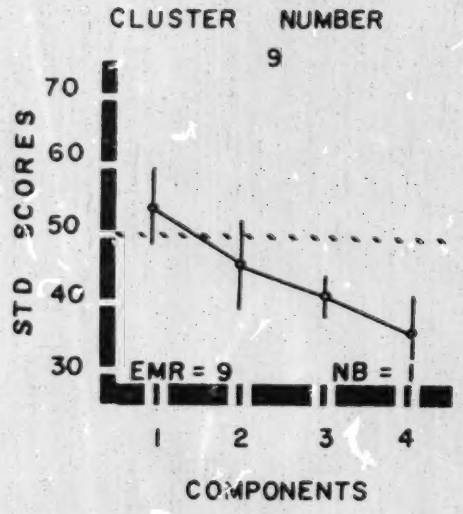

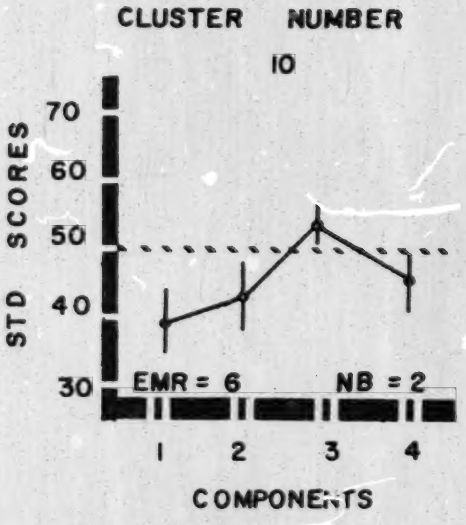

KEY to COMPONENTS.

1 = Strength / Power / Body Size.

2 = Gross Body Coordination.

3 = Fine Motor Abilities.

4 = Balance.

EMR = Educable Mental Retardates.

NB = Intellectually Normal.

FIGURE 1. (continued)

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